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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit: 1752
Application of: Dhal et al.
Serial No.: 08/970,066
Filed: November 13, 1997
For: HOLOGRAPHIC MEDIUM AND PROCESS FOR
USE THEREOF
Examiner: Angebranndt, M.

Cambridge, Massachusetts
March 16, 1999

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AMENDMENT AFTER FINAL REJECTION

Assistant Commissioner for Patents
Washington DC 20231

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Sir:

In response to the final Office Action issued November 17, 1998 in connection with the above application, the following is submitted.

The applicants gratefully note the withdrawal of the rejections based upon JP 05-094014 and the 35 USC 112 rejection.

The 35 USC 103 rejection of claims 1-4 and 12-14, as unpatentable over Dhal et al., International Application Publication No. WO 97/1318 (hereinafter simply "Dhal") in view of Ohe, U.S. Patent No. 5,689,345 and Keys et al. U.S. Patent No. 4,950,567, is traversed. More specifically, this rejection is traversed on the grounds that a skilled addressee would not combine these references in the manner suggested by the Examiner.

In the previous Amendment, the applicant noted that Dhal describes a process which is generally similar to that of the present invention except that it does not use a mixture of difunctional and polyfunctional epoxide monomers. Applicants also conceded that polyfunctional epoxide monomers are known, and are known to be capable of cationic polymerization, as taught by Ohe. However, applicants maintained that there is nothing in the prior art to teach the skilled person that using a mixture of difunctional and polyfunctional epoxide monomers will provide a medium

with the minimal shrinkage required for good digital data storage holographic performance. Specifically, Keys teaches a recording medium comprising a polymeric binder, an ethylenically-unsaturated liquid monomer, a plasticizer and a photoinitiator. The ethylenically-unsaturated monomers used are capable of free radical but not cationic polymerization. Column 6, lines 17-45 of Keys states that where cross-linking is desirable, for example during thermal enhancement or curing, up to about 5 weight percent of at least one multifunctional monomer *containing two or more terminal ethylenically unsaturated groups* typically is incorporated into the photopolymerizable layer (emphasis added). This is not surprising, since the use of tri- or higher functional unsaturated monomers to rigidify polymers is well known in polymer technology. However, the applicants maintained that such rigidification has nothing to do with the problem facing the present inventors, because it has not shown that this rigidifying effect can be extrapolated from polymers formed from ethylenically-unsaturated monomers to polymers formed by cationic polymerization of epoxide monomers. More importantly, the applicants pointed out in the previous Amendment, there is no reason why anyone would be concerned about rigidifying the exposed Dhal composition.

The Examiner now disagrees with the foregoing argument, noting that increased crosslinking and the resultant increase in rigidity due to it would be expected to reduce shrinkage as *the more rigid structure would be more resistant to forces acting upon it* (emphasis in original), and this would be appreciated for polyfunctional monomers irrespective of the mechanism by which the crosslinking occurs. Additionally, the Examiner states, increased refractive index modulation and resistance to abrasion and/or swelling (causing drift of replay wavelength) could reasonably be expected by one skilled in the art.

It is respectfully submitted that the Examiner's argument confuses the mechanical behavior of a formed polymer in response to forces acting thereon, with the behavior of a mixture of monomers undergoing polymerization to form a polymer. Obviously, the more rigid a finished polymer, the greatest its resistance to forces acting on it, and the less the deformation caused by such forces. However, the reduced shrinkage with which this invention is concerned is not really a property of

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the final polymer, but rather of the difference between the volumes of the unpolymerized mixture of monomers and the partially polymerized hologram. There is no *a priori* logical correlation between the volume change during the polymerization step and the rigidity of the final product, and nothing in any of the references indicates any empirical correlation on this point. Indeed, to the extent that most polymerizations are accompanied by some shrinkage (as might be expected in view of the fact that the new bonds formed during polymerization reduce the distances between adjacent atomic nuclei from the larger Van der Waals distance to the smaller distance characteristic of a covalent bond), the increased number of covalent bonds formed by incorporation of multifunctional monomers might be expected to increase shrinkage rather than decrease it. At the least, it would not be possible for the skilled worker to predict in advance what effect incorporation of the polyfunctional monomer would have on the shrinkage of the holographic medium.

Finally, it is unclear why the Examiner concludes, on the basis of Keys, that the use of polyfunctional monomers would lead to increased refractive index modulation. If the Examiner is saying that use of multifunctional monomers would be expected to lead to a denser polymer, and hence to greater refractive index changes (increased refractive index usually being associated with increased average electron density within a solid), this may well be true, but increased polymer density necessarily implies greater shrinkage during polymerization, which is the opposite of the effect achieved by the present invention.

The 35 USC 103 rejections set out in Paragraphs 4 and 5 of the Office Action, which both rely upon the combination of Dhal, Ohe and Keys, are traversed for the same reasons as the 35 USC 103 rejection of claims 1-4 and 12-14 set out in Paragraph 4, as discussed above.

For all the foregoing reasons, the 35 USC 103 rejections are unjustified and should be withdrawn.

Reconsideration and allowance of all claims remaining in this application is requested.

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A Notice of Appeal, a Petition for Extension of Time for the filing of this Amendment, and a check in payment of the relevant fees for the Notice of Appeal and Petition, are being filed herewith.

Respectfully submitted



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CERTIFICATE OF MAILING

I hereby certify that this paper, dated March 16, 1999, is being deposited with the United States Postal Service as first class mail in an envelope addressed to Assistant Commissioner for Patents, Washington DC 20231, on *March 16, 1999*.



David J. Cole